Plan d'action SAINT-LAURENT 2011-2026

Bird surveys (summer 2017) prior to wildlife habitat restoration at five sites in the Lake Saint-Pierre shoreline

Berthierville-Maskinongé Area

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1. Introduction

Lake Saint-Pierre and its floodplain, which is the most extensive in Quebec, are a key component of the St. Lawrence ecosystem. With more than 280 migratory and resident bird species and 78 fish species, the lake offers an exceptional natural environment which has received international recognition for its rich biodiversity (UNESCO Biosphere Reserve and RAMSAR site).

Agricultural activities have been carried out on the fertile floodplain of Lake Saint-Pierre for several centuries. Beginning in the second half of the 20th century, perennial crops were gradually replaced by annual crops, even in the lake's 2-year floodplain (Dauphin and Jobin, 2016). Agricultural practices associated with annual cropping have resulted in degradation of natural habitats and reduced the amount of habitat available for many wildlife species (Latendresse et al., 2008; Rioux et al., 2009). Grassland birds (Bobolink, Eastern Meadowlark, etc.), whose populations are in decline (NABCI, 2012), and waterfowl are among the species that have been adversely affected by the disappearance of wet meadows and the conversion of perennial crops to annual crops. The loss of plant substrates due to fall tillage creates soil erosion during high water periods and results in the destruction of key spawning and rearing grounds used by fish in the spring. This degradation has played a key role in the decline of the yellow perch population in Lake Saint-Pierre (Magnan et al., 2017). To date, roughly 5,000 hectares of potential yellow perch spawning habitat has been lost (TCRLSP, 2017).

With the aim of balancing agricultural activities and wildlife protection, an approach has been developed for restoring wildlife habitats on the shoreline of Lake Saint-Pierre (Groupe de travail « Intendance en milieu agricole: culture du littoral au lac Saint-Pierre », 2010). This approach involves stream maintenance (bank reshaping, planting, etc.) and conversion of annual crops back to perennial crops or natural grasslands. To this end, various enhancements will be implemented in 2017-2018 in the Berthierville and Maskinongé areas to help restore the ecological functions of Lake Saint-Pierre.

Bird surveys were conducted in the summer of 2017 in order to obtain a picture of the avifauna present in a wildlife habitat enhancement area (agricultural field) and along four watercourses prior to the restoration and enhancement work. The surveys provide baseline data that can be used to evaluate the potential benefits of the enhancements for the birds.

This approach is part of the project to restore the Lake Saint-Pierre shoreline, which is being carried out jointly by the Canadian Wildlife Service (CWS) of Environment and Climate Change Canada (ECCC) and the Quebec Department of Forests, Wildlife and Parks (MFFP), as part of the 2016–2021 programming for the St. Lawrence Action Plan (SLAP).

2. Methodology

2.1 Location and description of bird survey sites

The bird surveys were carried out in the northwestern part of the Lake Saint-Pierre floodplain, specifically in a wildlife habitat enhancement area (Segment 5) and along four watercourses: De Biais Creek, Marais de la Presqu'île, Chenal du Nord and Fossé de la Baie. See Figure 1 for the locations of these sites.

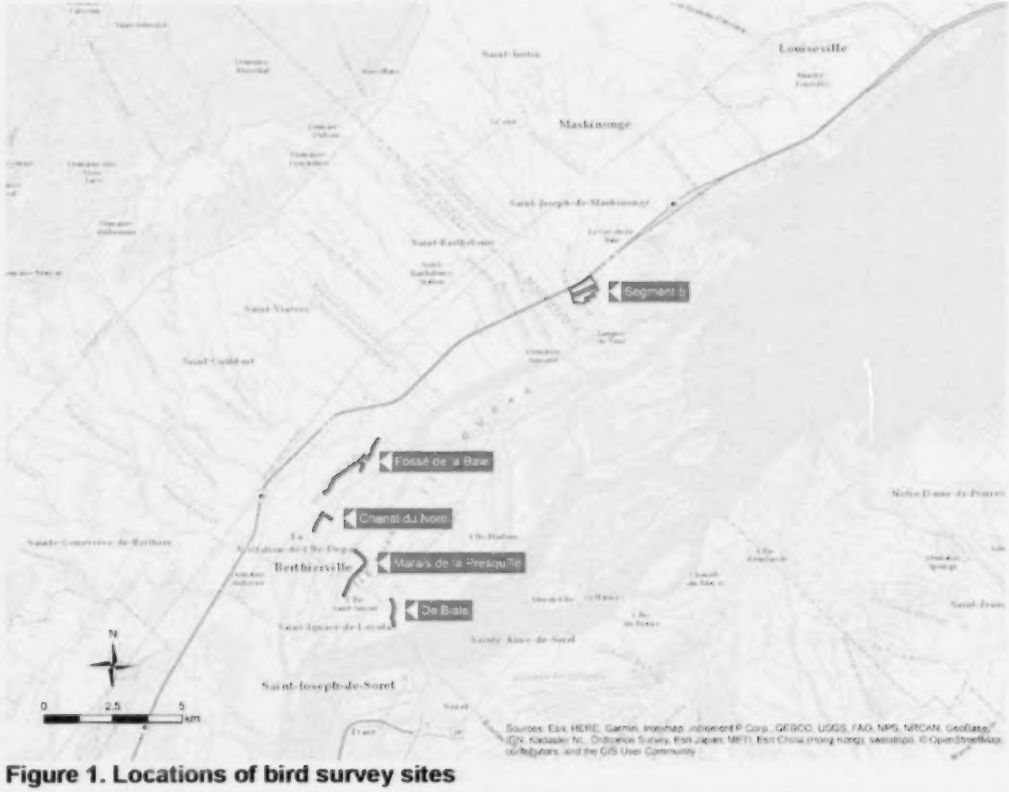


Figure 1. Locations of bird survey sites

2.1.1 Segment 5

Segment 5, a wildlife habitat enhancement area located in the municipality of Maskinongé (Maskinongé regional county municipality, RCM), belongs to Ducks Unlimited Canada (DUC) and is part of a large wetland complex known as the Saint-Barthélemy staging area. A strip of privately owned land is located in the middle of Segment 5 (MERN, 2017). The land owned by DUC covers a total area of 49 ha. Although agricultural land dominates the landscape (Figure 2), there are also some natural habitats such as treed and shrubby swamps, wet meadows and the Rivière du Bois-Blanc, which runs along the western boundary of the property. In 2017, DUC bought back the agricultural leases in the area, which halted farming activities. Restoration work in Segment 5 began in the fall of 2017 and was set to continue during the winter of 2018.

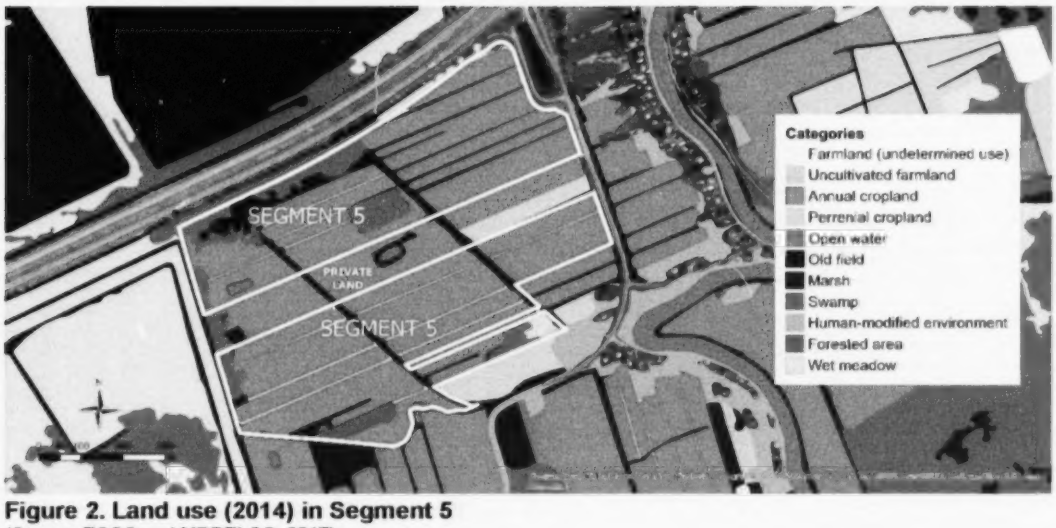


Figure 2. Land use (2014) in Segment 5
(Source: ECCC and MDDELCC, 2017)

It should be noted that, for the bird surveys, the strip of private land in the middle of Segment 5 was considered an integral part of the segment. Since this piece of land covers a fairly small area and its plant composition is similar to that on nearby land, it was assumed that including it in the bird surveys would not affect the results in terms of the avifauna present in Segment 5. In 2017, water levels were exceptionally high and, as a result, the fields were covered with water, scattered weeds and crop residues (untilled land). At the height of the spring floods in 2017, around the first week of May, the site was completely submerged. During the bird surveys conducted in June, 30% to 70% of the total area of Segment 5 was still under water, an unusual situation for that time of year.

2.1.2 Watercourses

The four watercourses selected for the bird surveys are located in a landscape dominated by farmland and other human-modified habitats (Figure 3). Two of the watercourses are located in the Îles de Berthier area and the other two in the municipality of Sainte-Geneviève-de-Berthier. Restoration of the four watercourses, originally planned for 2017, has been postponed to 2018–2019.

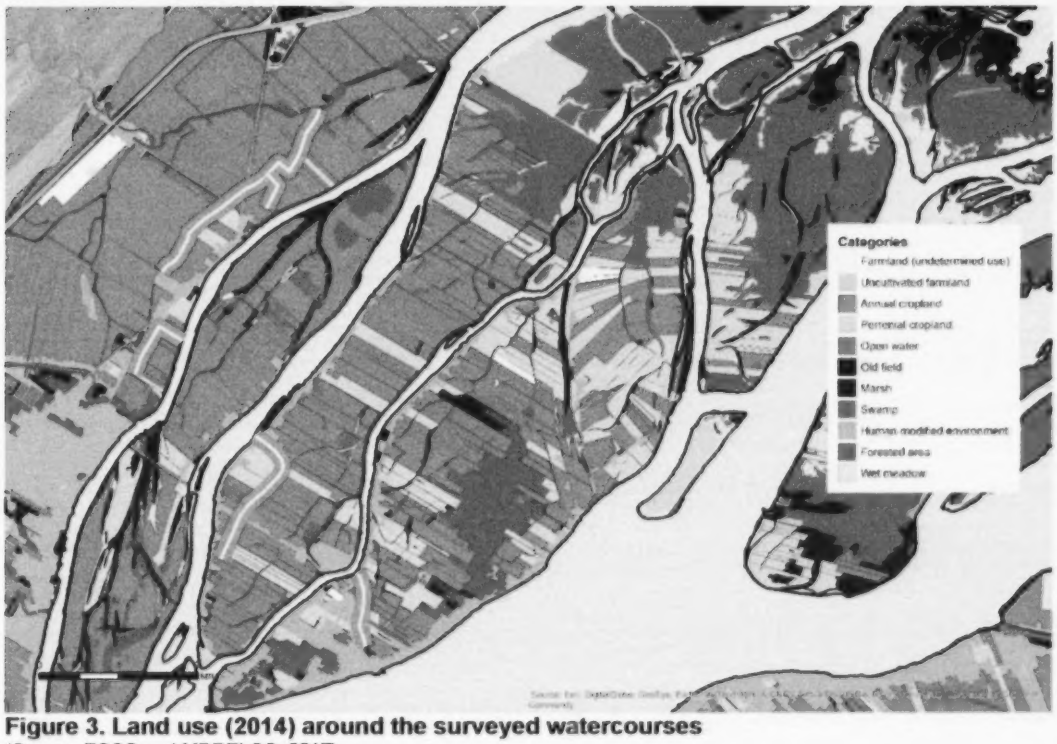


Figure 3. Land use (2014) around the surveyed watercourses
(Source: ECCC and MDDELCC, 2017)

De Biais Creek

This approximately 1-km-long creek is located in the municipality of Saint-Ignace-de-Loyola, in the D'Autray RCM (Figure 4). It originates in a marsh and drains several farm properties before emptying into Chenal des Épouffettes, a channel that runs between Île Saint-Ignace and Île Dupas. Its banks are bordered by annual and perennial crops and by the town of Saint-Ignace-de-Loyola. In June when the surveys were conducted, a strip of untilled, non-vegetated land of variable width was present in nearly all of the fields. This land had been covered by the spring floods and was still too wet to be tilled when farmers completed their seeding. The vegetated riparian strip along the watercourse is fairly narrow, but nonetheless has appreciable structural heterogeneity (grasses, trees, and shrubs).

Marais de la Presqu'île

The 2-km-long Marais de la Presqu'île watercourse, which is located in the municipality of La Visitation-de-l'Île-Dupas, in the D'Autray RCM (Figure 4), drains the farmland in the southwestern part of Île Dupas (annual and perennial crops) and empties into Chenal aux Castors, a channel between Île Dupas and Île aux Castors. In the section northeast of Route 158, the watercourse widens, offering a variety of habitats suitable for wildlife, such as marshes and treed swamps. A strip of untilled, non-vegetated land was present on both sides of this watercourse in June, because the flood waters had receded fairly recently.

Figure 4. Locations of the watercourses surveyed in the Îles de Berthier area

Chenal du Nord

Chenal du Nord, 1.1-km-long, is located in the municipality of Sainte-Geneviève-de-Berthier, in the D'Autray RCM (Figure 5). This watercourse drains farmland (annual and perennial crops) and empties into the channel (also called Chenal du Nord) between Île aux Castors and the north shore of the St. Lawrence River. A sparsely vegetated narrow riparian strip is present on both sides of the watercourse, which has a 350-m stretch of marsh near the point where it empties into the Grand (large) Chenal du Nord. A short section located farther west appears to have been filled in.

Fossé de la Baie

Fossé de la Baie, 3.7-km-long (portion under study), is located in the municipality of Sainte-Geneviève-de-Berthier, in the D'Autray RCM (Figure 5). It drains farmland planted with annual and, to a lesser extent, perennial crops. The riparian strip along this watercourse has less tree cover than the other three watercourses; it is dominated by herbaceous plants and shrubs. The watercourse nonetheless has several wider sections bordered with marshes and it has a treed swamp at its northeastern tip. A 0.6-km section near the source of the watercourse was filled in at some point; surveys were not carried out along that stretch. Because the ground near the watercourse was still too wet to support the weight of farm machinery during the seeding period, there was a strip of non-vegetated and untilled land on both sides of the watercourse.

Figure 5. Locations of the watercourses surveyed in the Sainte-Geneviève-de-Berthier area

2.2 Bird survey methods

The first phase of the work involved determining whether any species at risk frequented the sites under study. The presence of such species would have made it necessary to use survey methods adapted to species at risk or, if not already done, to make adjustments to the planned restoration work taking this information into account. Data from the Centre de données sur le patrimoine naturel du Québec (CDPNQ, 2017) were used for this purpose. Since no species at risk were found in the CDPNQ database, the work was planned without making any special adjustments in that regard.

The methods chosen for the bird surveys were designed to detect the majority of species present at the sites and also obtain relative abundance data for some of the species. When necessary (Segment 5), a random sampling technique was used.

2.2.1 Segment 5

The point count survey method was chosen for Segment 5 in Maskinongé. Although specifically designed for songbirds, this method can be used to detect and count many other species as well (by sight or sound), particularly in open habitat with few visual obstructions, such as Segment 5.

The point count survey method involves recording all birds seen or heard at given locations scattered across a specific area. Two techniques were combined for this purpose, specifically Unlimited Distance Point Counts (UDPC, also known as IPA) and fixed-radius counts. The UDPC technique involves counting all birds detected,

regardless of their distance from the point count location. With the fixed-radius technique, only birds detected within a pre-determined radius (in this case, 75 m) are recorded. Combining these two methods makes it possible to obtain more information about the birds that use the habitat surveyed. The fixed-radius technique can be used to compare a given species' abundance in different types of habitat (i.e., distance of detection may differ) and to compare the abundance of different species (i.e., distance of detection of the different birds' calls/songs may differ). Such comparisons are possible because the fixed-radius technique standardizes the survey radius for all species and all habitats. UDPC data are generally used to compare differences in individual species' abundance among sites with similar habitats (i.e., distance of detection of each species is similar). They are used to complement the fixed-radius count results in order to present an overall picture of the bird species occurring during the breeding season in the habitats studied.

The fixed radius was set to 75 m (the distance at which the songs of most species can be heard) and the point count duration to 20 minutes. To increase the probability of detection, each point count location was to be visited twice, at least seven days apart, during the month of June 2017.

For each individual detected, the observer was required to record the bird's position in relation to the 75-m radius (whether located within or outside of the radius), its position relative to the enhancement area (within or outside of it or in the privately owned land in the middle of the enhancement area), the bird's sex (if possible), the type of detection (visual [individual, nest, family group] or auditory [call, song]) and the habitat used. Only the behaviour most indicative of breeding was recorded for a given individual. Therefore, when a bird uttered both a call and a song during the 20-minute point count period, only the song, a territorial behaviour, was recorded. If this same individual was observed on a nest or accompanied by young, this is the information that was recorded because it enabled confirmation of breeding. When two or more birds were heard or seen simultaneously, they were treated as different individuals. The same is true in cases where detections were so far apart they could not involve a single individual. When in doubt, the observer was to treat the detection as a single bird. The point count field sheet is presented in Appendix A.

During data compilation, the following convention was used: a bird seen or heard calling (male or female) = 0.5 pair; a singing male, a nest or a family = 1 pair. In the case of locations visited twice, the highest value for a given species was retained (better indicator of the carrying capacity of the environment). Individuals that merely flew over the habitat without using it (e.g., vultures or gulls high in the air) were not retained when the data were compiled. However, individuals feeding in flight (e.g., swallows) or flying within or over the habitat were counted. The data from the fixed-radius count and the UDPC were compiled separately for subsequent analyses.

A single observer performed the counts. The point counts, totalling 21, were carried out between sunrise and 10:00 a.m., the time of day when songbirds are most active. An initial outing covering seven point count locations took place on June 11, 2017. Spring flood water still covered about 70% of the site. A visit covering all 21 point count locations was made roughly a week later, on June 19, 20 and 21, 2017, at which time water still covered 30% of the site (the western part). The survey conditions, which were recorded on the field sheet for each point count, varied but were acceptable in the circumstances: clear to overcast skies, little to no rainfall and light to strong winds.

Selection of point count locations

The point count locations were selected by computer using the ArcGIS program and shapefiles representing the boundaries of Segment 5 and land use in the area in 2014. A satellite image was used as a base map. A hexagonal grid with a 75-m radius was superimposed on the map to visualize the survey sample for the selection of count locations.

In all, 21 point count locations were retained (Figure 6). They were distributed systematically in a staggered pattern (random sampling technique; Scherrer, 1984) so as to adequately cover the area to be surveyed; they were thus distributed along six (6) lines in an east–west direction. It was determined that for each of the two planned visits, it would take at least two mornings to cover the 21 point count locations. On one morning, the observer was required to do the counts by skipping every second line of points in order to optimize coverage of the site.

Garmin's BaseCamp program was used to transfer the geographic coordinates of the locations to a GPS for the field visits. The coordinates are available in Appendix B.

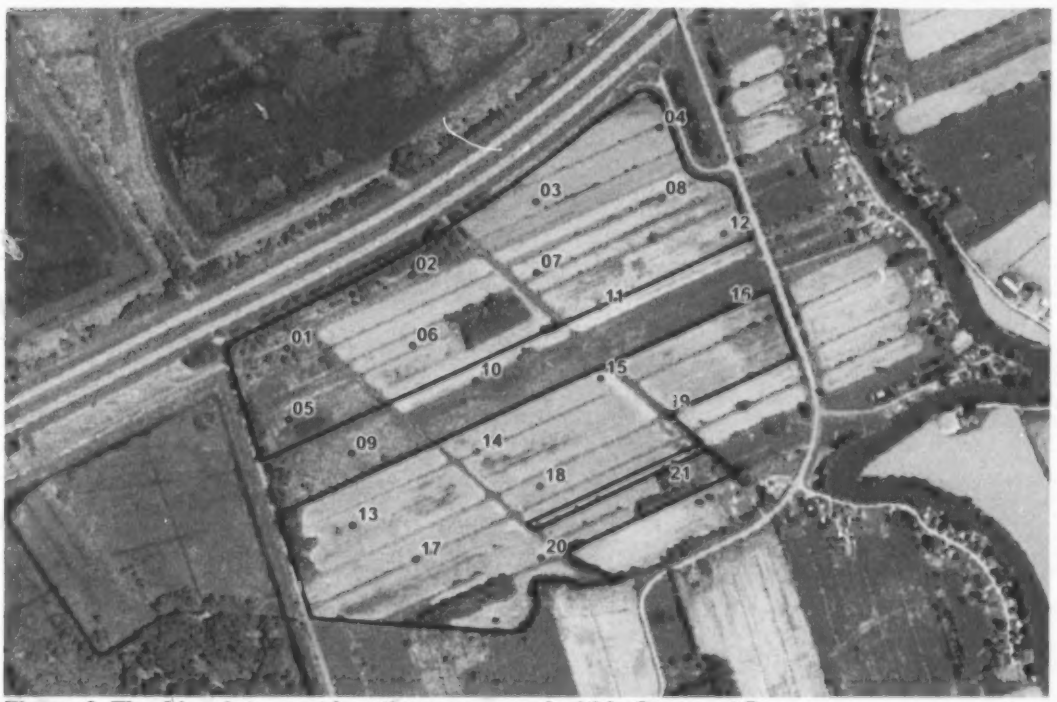


Figure 6. The 21 point count locations surveyed within Segment 5

2.2.2 Watercourses

The transect method was chosen for the bird survey along the four watercourses at Saint-Ignace-de-Loyola, La Visitation-de-l'Île-Dupas and Sainte-Geneviève-de-Berthier. This involved counting all birds detected by walking slowly (2–3 km/h) along one side of the watercourse and recording all the birds seen or heard nearby as well as in adjacent

habitats. All individuals detected on either bank were to be recorded (Deschênes et al., 1999; Jobin et al., 2001).

The observer was required to note the location of each bird detected in relation to the watercourse (open water, bank, vegetated riparian strip or adjacent habitat), its sex (if possible) and the type of detection (visual [individual, nest, family group] or auditory [call, song]). Only the behaviour most indicative of breeding was recorded for a given individual, under the logic described in the Segment 5 methods. When a bird was detected in the vegetated riparian strip, the observer was to note the plant composition, specifically whether it was dominated by trees, shrubs, herbaceous vegetation or a combination thereof. When a bird was recorded in the adjacent habitat, the observer was to specify the bird's position, that is, whether it was located within the first 25 m from the watercourse (immediately adjacent habitat) or farther than 25 m away (distant adjacent habitat); the type of habitat being used at the time was also recorded (Deschênes et al., 2003). Birds feeding in flight (e.g., swallows) or flying within the habitat or over it were recorded and counted, whereas birds merely flying over the site without using it (e.g., vultures or gulls high in the air) were recorded but not included in the total count. The field sheet used for the transect survey is presented in Appendix C.

Maps of the sites to be surveyed were produced in advance and the geographic coordinates were added to the maps (Appendix D), allowing the observer to determine his/her position in the field with a GPS. A single observer performed the counts. The sites were visited twice, more than seven days apart, during the month of June 2017. The surveys were carried out between sunrise and 9:00 a.m. under ideal conditions (clear to partly cloudy skies, no rainfall, and no wind to light wind).

During data compilation, detections of individuals were converted to numbers of pairs in keeping with the convention described in the section on Segment 5. To simplify the presentation of results, the term "riparian zone" is used in the Results and Discussion section to designate the zone including the water, bank, vegetated riparian strip and immediately adjacent habitat.

3. Results and Discussion

3.1 Segment 5

Owing to the exceptional spring floods of 2017, all 21 point count locations were surveyed only once in the month of June. During an initial outing, on June 11, when the water level in the St. Lawrence was about 1.25 m higher than normal (CEHQ, 2017), only seven point count locations were covered. Later, all 21 point count locations were surveyed over a three-day period (June 19, 20 and 21). Roughly half of the point count locations were under water at the time and had to be visited wearing waders. An unexpected rise in the water level at the end of June resulted in the cancellation of a potential second visit to all point count locations.

Segment 5, June 11, 2017. (Photo: Alexandre Nicole)

Because of the abnormally high water levels, the survey in Segment 5 could not be completed as planned. However, the results obtained provide a fairly good picture of the birds that are found at the site. The survey will be repeated in 2018 (even if the site has already been restored) and additional surveys will be conducted over the years. Over time, habitats and, therefore, bird populations, will evolve and it will be possible to monitor the gains achieved.

Based on the results of the fixed-radius and UDPC counts done this year, 41 bird species (regardless of type of detection) were observed within the boundaries of Segment 5 (including the strip of privately owned land in the middle) (Table 1). Two species flew over the site without using it: the Great Black-backed Gull (1 individual) and the Bonaparte's Gull (3 individuals). Two other species were only recorded outside the boundaries of Segment 5 (enhancement area): the Pied-billed Grebe (1 individual, Maskinongé marsh) and the Red-eyed Vireo (1 individual).

The high water levels that persisted until July 2017 may have attracted species that would not have used the site otherwise. Species whose presence or abundance was favoured by the high water levels during the breeding season are marked with an asterisk (*) in Table 1. They are the Canada Goose, the Mallard, the Ring-billed Gull, the Great Blue Heron, the Great Egret, the Black Tern, the Tree Swallow, the Bald Eagle

(designated vulnerable in Quebec) and the Turkey Vulture. What these species have in common is that they used flooded or non-vegetated areas in agricultural fields for feeding or resting. The availability of these habitats was increased owing to the floods of 2017. Several of the above-mentioned species were among the most abundant at the site: on June 19, about 590 Mallards were observed foraging and preening in the western part of Segment 5, which was still flooded. That same day, a group of 20 Ring-billed Gulls were also observed foraging in the bare fields and flooded habitats. Up to 36 Tree Swallows and 6 Black Terns were observed foraging in flight low over the site. While the terns mainly foraged in rain-swollen drainage ditches teeming with small fish, they were sometimes observed in flooded fields. Although Tree Swallow breeding was confirmed in Segment 5 based on the observation of an occupied nest, most of the Tree Swallows, as well as the Black Terns, likely nested in the Maskinongé marsh, north of Highway 40. Up to seven Great Blue Herons and three Great Egrets were sighted in the flooded fields. Three Bald Eagles were observed simultaneously at the site, feeding on animal carcasses left behind by the floods. A few Turkey Vultures flew very low over the site; a group of 26 individuals was also observed outside the site's boundaries, in search of carrion left behind by flood waters in the Lake Saint-Pierre floodplain.

Besides the Mallard, five other waterfowl species were found at the site: the Wood Duck, the Gadwall, the American Black Duck, the Northern Shoveler, and the Green-winged Teal. However, these species' numbers are too small to allow us to speculate about the effect of the spring floods on their abundance or even their presence in Segment 5.

The results indicate that although agricultural land dominates the landscape in Segment 5, these parcels of land do not rank among the habitats with the greatest abundance of birds. In fact, 11 species were detected there (Table 2), and five of them were most likely attracted to the site by the unusual presence of large expanses of water (Table 1). Other species were able to take advantage of drier areas on farmlands, including the European Starling, the American Robin, the Killdeer and the Common Grackle.

Swamps represent the habitat type with the greatest diversity of birds, with 16 species recorded there (Table 2). The few treed swamps in the area were used by the Black-capped Chickadee, the Yellow Warbler, the Downy Woodpecker, the Eastern Wood-Pewee (designated Special Concern in Canada), the Baltimore Oriole, the House Wren, the Great Crested Flycatcher, the Warbling Vireo and eight other species (Table 1).

Nine species used wet meadows, including the Song Sparrow, the Spotted Sandpiper, and the Yellow Warbler. Seven species, including the Song Sparrow and the Common Yellowthroat, used farm hedgerows.

Seven species were recorded in forested areas, among them the Baltimore Oriole, the White-breasted Nuthatch, the House Wren and the Warbling Vireo. The Gray Catbird, the Common Yellowthroat and the Common Grackle used old fields, while the Wilson's Snipe, the Swamp Sparrow, the Red-winged Blackbird and the Spotted Sandpiper occurred along the margins of drainage ditches.

Table 1. Species that used Segment 5 during the 2017 breeding season, as determined by the fixed-radius and point count survey methods

Code[1]	English Name	Habitat[2]
P	American Black Duck	OW; FL
T	American Crow	FO; SW
T	American Goldfinch	SW; (In flight)
S	American Robin	FH; FO; HU; UF
H	Bald Eagle*	UF; FL; (In flight)
T	Baltimore Oriole	FO; SW
H	Belted Kingfisher	(In flight)
AT[3]	Black Tern*	(In flight)
T	Black-capped Chickadee	SW
H	Blue Jay	SW
S	Brown-headed Cowbird	FH; SW
H	Canada Goose*	OW; UF; FL
T	Cedar Waxwing	(In flight)
AT[3]	Common Grackle	OF; SW; UF
T	Common Yellowthroat	OF; FH; HU
T	Downy Woodpecker	SW
T	Eastern Wood-Pewee	SW
AT[3]	European Starling	FH; UF
P	Gadwall	OW; FL
S	Gray Catbird	OF
H	Great Blue Heron*	OW; UF; FL; WM
T	Great Crested Flycatcher	SW
H	Great Egret*	UF; FL; WM
P	Green-winged Teal	OW; FL
S	House Wren	FO; SW
P	Killdeer	UF
P	Mallard*	OW; FL
H	Mourning Dove	(In flight)
P	Northern Shoveler	OW; FL
C	Red-winged Blackbird	FH; SW; WM
H	Ring-billed Gull*	UF; FL; WM
AT	Song Sparrow	FH; FO; SW; WM
T	Spotted Sandpiper	UF; FL; WM
T	Swamp Sparrow	WM
NO	Tree Swallow*	SW; (In flight)
H	Turkey Vulture*	(In flight)
T	Warbling Vireo	FO; SW
S	White-breasted Nuthatch	FO
S	Wilson's Snipe	UF; FL; WM
P	Wood Duck	OW
T	Yellow Warbler	FH; SW; HU; WM

[1] The highest level of breeding evidence obtained in Segment 5 (based on the nomenclature used in the Québec Breeding Bird Atlas). A description of breeding evidence is provided in Appendix E. Breeding evidence was retained (for suitable breeding habitat) taking into account that the farmland was not cultivated in 2017, the year of the surveys (and disregarding the flooding).

[2] Habitat types used within Segment 5. Habitat codes: AC = annual cropland; PC = perennial cropland; OW = open water (including the areas flooded due to high water levels); OF = old field; FH = farm hedgerow; MA = marsh; SW = swamp; HU = human-modified habitat; FO = forested area; UF = uncultivated farmland, FL = flooded land, WM = wet meadow.

[3] Species which were observed carrying food but which appeared not to be nesting within the boundaries of Segment 5.

*Species whose presence or abundance was favoured by the high water levels in 2017.

Table 2. Number of species observed in different habitats in Segment 5, 2017

Habitat	Number of species observed
Swamp	16
Uncultivated farmland	11
Wet meadow	9
Farm hedgerow	7
Forested area	7
Old field	3
Human-modified habitat	3
Marsh	0

Breeding by two species, the Song Sparrow (bird carrying food) and, as mentioned previously, the Tree Swallow (occupied nest), was confirmed at the site. The European Starling, the Black Tern and the Common Grackle were also observed carrying food, but the individuals concerned appeared to be travelling between Segment 5 and neighbouring sites, such as the Maskinongé marsh in the case of the Black Tern.

From Table 1, it can also be seen that certain species used up to four different types of habitat (Song Sparrow, American Robin, and Yellow Warbler), while others used only one type (for example, the Gray Catbird, the Downy Woodpecker, the Eastern Wood-Pewee, the White-breasted Nuthatch and the Great Crested Flycatcher).

The floods probably had an adverse effect on some ground-feeding and ground-nesting bird species, including the Song Sparrow and the Killdeer. The Horned Lark and the Vesper Sparrow, two species that nest on the ground and are known to breed in the region (AONQ, 2017), were not found at the site.

Relative abundance

The fixed-radius survey results were used to compare the relative abundance of the different species found within Segment 5 (Table 3).

It should be noted that relative abundance values are used for comparison purposes only. They do not indicate the actual number of pairs present, on average, in the area surveyed (here, within a radius of 75 m). With a relative method like the fixed-radius count method, any individual detected within the area surveyed is counted as 0.5 pair or 1 pair, regardless of whether all or part of its territory is located there. The small area (1.8 ha) covered with the fixed-radius technique reduces the precision of the results. In fact, the relative abundance values correspond to the number of individuals of the different species detected that were observed at the same locations under similar conditions (in this case, within a radius of 75 m, during a 20-minute count interval, 1 to 2 visits, etc.), based on the assumption that the most abundant species at the site will be detected in the greatest number and vice versa.

It should be noted that for some species, particularly non-territorial species or species that occupy very large territories (ducks, gulls, Bald Eagles, vultures, etc.), the results of the fixed-radius counts cannot be used to adequately quantify abundance (see Table 3). Since this method is designed for counting territorial songbirds, caution should be exercised in making certain interpretations.

The results obtained indicate that the most abundant species in Segment 5 in 2017 were the Tree Swallow, the Song Sparrow, the Red-winged Blackbird, the Yellow Warbler, the

European Starling and the Common Grackle; these are species that are commonly found in open habitats or agricultural areas.

Table 3. Mean relative abundance of the species counted by the fixed-radius method during point count surveys in Segment 5, 2017

Species	Mean relative abundance (fixed-radius) in number of pairs	Rank
Tree Swallow	1.40	1
Song Sparrow	0.71	2
Red-winged Blackbird	0.45	3
Yellow Warbler	0.38	4
European Starling	0.33	5
Common Grackle	0.33	6
Killdeer	0.12	7
Swamp Sparrow	0.10	8
American Robin	0.10	9
Common Yellowthroat	0.10	10
Downy Woodpecker	0.10	11
Spotted Sandpiper	0.07	12
American Goldfinch	0.07	13
American Crow	0.07	14
Baltimore Oriole	0.07	15
Wilson's Snipe	0.05	16
Blue Jay	0.05	17
Black-capped Chickadee	0.05	18
Gray Catbird	0.05	19
House Wren	0.05	20
Warbling Vireo	0.05	21
Ring-billed Gull*	0.67	N.A.
Black Tern*	0.57	N.A.
Mallard*	0.33	N.A.
Turkey Vulture*	0.19	N.A.
Bald Eagle*	0.07	N.A.
Northern Shoveler*	0.05	N.A.
Gadwall*	0.02	N.A.
Belted Kingfisher*	0.02	N.A.

*Species whose abundance cannot be quantified from fixed-radius count results.

Frequency of occurrence

The five most abundant species are also the species that were most often detected on point counts (Table 4). The Tree Swallow, detected on 62% of point counts, flew across the site regularly while foraging. The Song Sparrow (52%) was associated with farm hedgerows, old fields and swamps, and the Common Grackle (38%) with bare fields from which the water had receded and with swamps.

Table 4. Frequency of occurrence of the species counted by the fixed-radius method during the point count survey in Segment 5, 2017

Species	Frequency (number of point count locations)	Relative frequency (%)	Rank
Tree Swallow	13	62	1
Song Sparrow	11	52	2
Common Grackle	8	38	3
European Starling	6	29	4
Yellow Warbler	5	24	5
American Goldfinch	3	14	6
American Crow	3	14	7
American Robin	3	14	8
Killdeer	3	14	9
Swamp Sparrow	2	10	10
Spotted Sandpiper	2	10	11
Baltimore Oriole	2	10	12
Common Yellowthroat	2	10	13
Downy Woodpecker	2	10	14
Wilson's Snipe	1	5	15
Red-winged Blackbird	1	5	16
Blue Jay	1	5	17
Black-capped Chickadee	1	5	18
Gray Catbird	1	5	19
House Wren	1	5	20
Warbling Vireo	1	5	21
Black Tern*	12	57	N.A.
Mallard*	10	48	N.A.
Ring-billed Gull*	4	19	N.A.
Gadwall*	3	14	N.A.
Bald Eagle*	3	14	N.A.
Turkey Vulture*	2	10	N.A.
Northern Shoveler*	1	5	N.A.
Belted Kingfisher*	1	5	N.A.

*Species for which the fixed-radius count results are not applicable or are inaccurate.

3.2 Watercourses

3.2.1 De Biais Creek

De Biais Creek was surveyed twice, on June 12 and 24, 2017. The surveys were carried out between sunrise and 9:00 a.m. under ideal weather conditions. The creek was overflowing its banks in a few places, but it was still possible to survey the entire transect.

In all, 34 species were observed during the surveys, of which 25 were using the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat [0 m–25 m]). The vegetated riparian strip (which included herbaceous plants, shrubs and trees) was the habitat used most by birds. More species were counted there than in the immediately adjacent habitat (which consisted primarily of annual cropland and other human-modified environments): 15 versus 12. Most significantly, the riparian strip had on average three times as many pairs of birds per kilometre of shoreline (Table 5).

Table 5. Mean relative abundance per kilometre of shoreline and habitats used by birds: De Biais Creek and adjacent habitats, 2017 surveys

Code[1]	Species	Watercourse and riparian strip[2]		Adjacent habitat 0-25 m		Total riparian zone[4]	Adjacent habitat > 25 m	
		Mean abundance (pairs / km)	Habitat[3]	Mean abondance (pairs / km)	Habitat[5]	Mean abundance (pairs / km)	Mean abondance (pairs / km)	Habitat[5]
T	Alder Flycatcher						1	FH
H	American Bittern	1	H			1		
H	American Crow						0.5	FO
S	American Goldfinch	0.5	In flight			0.5		
S	American Redstart			1	SW	1		
JE	American Robin	4	H; T	1	AC; HU	5	2	HU
S	Baltimore Oriole			1	FO	1		
T	Black-capped Chickadee						1	HU
S	Bobolink						1	PC
T	Cedar Waxwing	1	T			1		
H	Chimney Swift	1	In flight			1		
AT	Chipping Sparrow			1	HU	1	2	HU
JE	Common Grackle	3.5	H; T	1	AC	4.5		
T	Common Yellowthroat	1	H+S+T	1	FH	2	1	FH
S	Downy Woodpecker	2	T			2		
S	Eastern Kingbird	1	S			1		
H	European Starling	0.5	T			0.5	1	FO
S	Gray Catbird						1	FH
H	Great Blue Heron	0.5	W			0.5		
S	House Finch						1	HU
NO	House Sparrow			2	HU	2		
S	Killdeer			1	AC	1		
P	Mallard	1.5	W			1.5		
H	Mourning Dove	1	T	1	HU	2		
S	Red-eyed Vireo	4	T	1	FH	5	2	FO; HU
P	Red-winged Blackbird	9.5	H; T; H+T; H+S+T	1	FH	10.5	2	FH
S	Savannah Sparrow						1	PC; AC
T	Song Sparrow	3.5	H; T; S+T; H+S; H+S+T			3.5	4	FH; HU
S	Spotted Sandpiper	0.5	H			0.5		
S	Swamp Sparrow						1	MA
H	Tree Swallow	0.5	In flight			0.5		
T	Warbling Vireo						1	HU
DD	Wilson's Snipe	2	H			2		
T	Yellow Warbler	5	T; S+T	1	SW	6	2	FH
	(Total: 34 species)		Vegetated riparian strip only					
	Total	43.5	39.5	12		56.5	24.5	
	Number of species	20	15	12		25	17	

[1] Code = Category of breeding evidence observed (using codes from the Quebec Breeding Bird Atlas). Descriptions of the categories appear in Appendix E.

[2] Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

[3] W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

[4] Total riparian zone = water + bank + riparian strip + adjacent habitat (0 m–25 m).

[5] Habitat codes: AC = annual cropland; PC = perennial cropland; OW = open water; OF = old field; FH = farm hedgerow; MA = marsh; SW = swamp; HU = human-modified environment; FO = forested area; WM = wet meadow; UF = uncultivated farmland.

The most abundant species in the riparian zone was the Red-winged Blackbird; with the Yellow Warbler in second place, the American Robin and the Red-eyed Vireo tied for third; and the Common Grackle and the Song Sparrow in fourth and fifth place, respectively. Together, these six species represented 61% of the pairs observed. All of them used the vegetated riparian strip more than the immediately adjacent habitats (from 4.5 to 9.5 times as many pairs were counted per kilometre of shoreline). These results clearly illustrate the birds' attraction to vegetated riparian strips.

In the riparian zone, the Red-winged Blackbird and the Song Sparrow were observed mostly among the herbaceous plants, shrubs and trees along the creek. The Yellow Warbler was associated with trees, shrubs and swamps, the American Robin with herbaceous vegetation, and the Red-eyed Vireo with wooded areas along the creek. The Common Yellowthroat was observed in farm hedgerows; the Killdeer, in annual cropland bordering the creek.

The Wilson's Snipe, the American Bittern, the Mallard, the Spotted Sandpiper and the Great Blue Heron are the only species associated with aquatic habitats that were observed near the creek.

The birds observed in more distant adjacent habitat (> 25 m) provide an indication of the species that frequent the landscape surrounding De Biais Creek. In all, 17 species were observed in these habitats consisting of annual and, to a lesser extent, perennial cropland. The Alder Flycatcher and the Gray Catbird were seen in farm hedgerows; the Savannah Sparrow and the Bobolink (designated Threatened in Canada), in perennial cropland. The Chipping Sparrow, the Chimney Swift (designated Threatened in Canada) and the House Finch were associated with the nearby human-built environment (the village of Saint-Ignace-de-Loyola). The Chimney Swift was also observed flying above the creek.

Three species flew over the site without stopping: the Canada Goose (50 individuals), the American Crow (1 individual) and the Ring-billed Gull (6 individuals).

A broad-leaved arrowhead (*Sagittaria latifolia*) marsh in the upstream portion of De Biais Creek (left). The creek offers a number of different habitat types. Both photographs were taken on June 24, 2017. (Photos: Alexandre Nicole)

3.2.2 Marais de la Presqu'île

Marais de la Presqu'île was surveyed twice, on June 12 and 24, 2017. The surveys were carried out between sunrise and 9:00 a.m. under ideal weather conditions. The watercourse was overflowing its banks in a few places, but it was still possible to survey the entire transect.

In all, 37 species were observed during the surveys of Marais de la Presqu'île, 28 of them in the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat). The vegetated riparian strip (composed of herbaceous plants, shrubs and trees) was the habitat used most frequently by birds. More species were counted there than in the immediately adjacent habitat (which consisted mainly of annual cropland, with some perennial crops): 22 versus 12 species, respectively (83% more). Most notably, there were four times as many pairs per kilometre of shoreline, on average, in the vegetated riparian strip (Table 6).

In addition to the Mallard, which was the most abundant bird, the species observed most frequently in the riparian zone (in descending order) were the Song Sparrow, the Red-winged Blackbird, the Common Grackle, the European Starling and the American Robin tied for fourth place, and the Yellow Warbler and the Red-eyed Vireo, tied for fifth place; together, they represented 71% of the pairs observed. Seven of those eight species were found in the vegetated riparian strip and only one (the Mallard) in the watercourse. Four of them were also observed in the immediately adjacent habitat: the Song Sparrow, the Red-winged Blackbird, the European Starling and the American Robin. However, larger numbers of them were found in the vegetated riparian strip than in the immediately adjacent habitat (from 1.5 to 9 times more pairs, on average, per kilometre of shoreline). These results once again demonstrate the birds' attraction to vegetated riparian strips. Lastly, except for the Mallard and the European Starling, the above-mentioned species were also the most abundant at De Biais Creek.

In the riparian zone, two other waterfowl species in addition to the Mallard were using the watercourse for foraging and breeding: the Wood Duck and the Gadwall. Mallard breeding was confirmed when nine ducklings were observed on June 12. The Song Sparrow frequented farm hedgerows and the most densely vegetated parts of the riparian strip (with trees and shrubs). The Red-winged Blackbird showed the same habitat preferences as the Song Sparrow but was also found in riparian strips with only herbaceous vegetation and on perennial cropland. The American Robin and the European Starling were observed along the watercourse, but also on perennial cropland and in human-modified environments.

There were a number of trees on either side of the watercourse down to its mouth, northeast of Route 158, including some in small treed swamps. Those swamps, which were part of the watercourse and its vegetated riparian strip, were used by the Wood Duck, the Downy Woodpecker, the Eastern Wood-Pewee (designated Special Concern in Canada), the Common Grackle and the Baltimore Oriole. Breeding of the Common Grackle was confirmed by the observation of a bird carrying food; that of the Downy Woodpecker, by the observation of nestlings.

Table 6. Mean relative abundance per kilometre of shoreline and habitats used by birds: Marais de la Presqu'île and adjacent habitats, 2017 surveys

Code[1]	Species	Watercourse and riparian strip[2]		Adjacent habitat 0-25 m		Total riparian zone[4]	Adjacent habitat > 25 m	
		Mean abundance (pairs / km)	Habitat[3]	Mean abondance (pairs / km)	Habitat[5]	Mean abundance (pairs / km)	Mean abondance (pairs / km)	Habitat[5]
S	American Bittern	0.25	H			0.25		
JE	American Crow	1	T			1		
P	American Goldfinch	1	H; T	0.5	FO	1.5	0.75	FH; HU
JE	American Robin	2	H; T; H+T	0.5	PC	2.5	2.25	HU
P	Baltimore Oriole	1	T; H+T	0.5	FO	1.5	0.5	FO
H	Barn Swallow						0.25	PC
T	Black-capped Chickadee	0.5	T			0.5	1	HU
T	Blue Jay	0.25	T	0.5	FO	0.75	0.25	HU
T	Bobolink						2	PC
S	Brown Thrasher						0.5	HU
S	Brown-headed Cowbird			0.5	FO	0.5		
T	Chipping Sparrow			0.5	HU	0.5	1.5	HU
AT	Common Grackle	3.75	H; T			3.75	0.5	HU
P	Common Yellowthroat	0.5	T	0.5	OF; FH	1	0.5	OF; FH
NJ	Downy Woodpecker	1	T			1	0.5	FO
S	Eastern Kingbird	0.5	H+T			0.5		
S	Eastern Wood-Pewee	0.5	T			0.5		
JE	European Starling	2	H; T	0.5	HU	2.5	2.25	PC; HU
P	Gadwall	0.5	W	0.5	AC	1		
H	Great Blue Heron	0.5	H			0.5		
H	House Sparrow						1	HU
S	House Wren						0.5	HU
S	Killdeer						0.25	AC
JE	Mallard	11.75	W			11.75		
T	Mourning Dove	0.25	T	0.5	HU	0.75	0.5	AC
S	Northern Flicker	0.5	T			0.5		
S	Red-eyed Vireo	2	T			2	0.5	FO
P	Red-winged Blackbird	3.25	H; T; H+S; H+T	2	PC	5.25	0.5	FH
X	Ring-billed Gull						0.5	
T	Savannah Sparrow						0.5	PC
T	Song Sparrow	7	S; T; H+T; H+S+T	0.75	FH; HU	7.75	4	FH; HU
S	Swamp Sparrow						0.5	FH
H	Tree Swallow	1	In flight			1		
T	Warbling Vireo	0.5	T			0.5	0.5	FO
T	White-breasted Nuthatch	0.5	T			0.5		
H	Wood Duck	0.75	W			0.75		
T	Yellow Warbler	2	T; H+S; H+T; H+S+T			2		
	(Total: 37 species)		**Vegetated riparian strip only**					
	Total	44.75	30.75	7.75		52.5	22	
	Number of species	26	22	12		28	24	

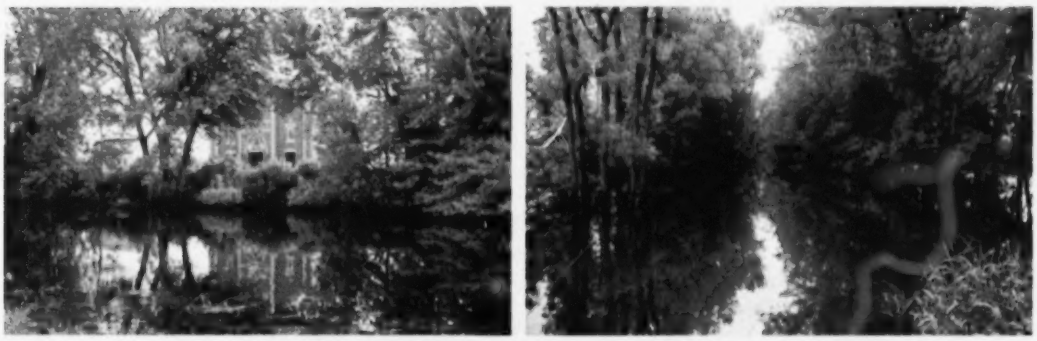
[1] Code = Category of breeding evidence observed (using codes from the Quebec Breeding Bird Atlas). Descriptions of the categories appear in Appendix E.

[2] Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

[3] W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

[4] Total riparian zone = water + bank + riparian strip + adjacent habitat (0 m–25 m).

[5] Habitat codes: AC = annual cropland; PC = perennial cropland; OW = open water; OF = old field; FH = farm hedgerow; MA = marsh; SW = swamp; HU = human-modified environment; FO = forested area; WM = wet meadow; UF = uncultivated farmland.



Marais de la Presqu'île, June 12, 2017. Right: An example of a swamp used by species including the Eastern Wood-Pewee and the Wood Duck. (Photos: Alexandre Nicole)

Breeding of the American Crow, the European Starling and the American Robin was confirmed through the observation of young in the riparian strip. However, it was impossible to determine with certainty whether those species had nested within the riparian zone or in more distant adjacent habitat.

The results obtained in the more distant immediate habitats (> 25 m) provide an indication of the species that frequent the landscape surrounding Marais de la Presqu'île. In all, 24 species were counted in these habitats, which are made up largely of annual cropland with a smaller amount of perennial cropland and pasture. The Bobolink and the Barn Swallow, two species designated Threatened in Canada, as well as the Savannah Sparrow were seen or heard in the pastures and on the adjacent perennial cropland, and the Killdeer was observed on annual cropland. The Chipping Sparrow, the Brown Thrasher and the Mourning Dove were associated with human-built environments (the village core of La Visitation-de-l'Île-Dupas and other residences).

Two species flew over the site but did not land: the Double-crested Cormorant (1 individual) and the Bald Eagle (1 individual; species designated vulnerable in Quebec).

3.2.3 Chenal du Nord

Chenal du Nord was surveyed twice, on June 13 and 25, 2017. The surveys were carried out between sunrise and 9:00 a.m. under ideal weather conditions. The watercourse was overflowing its banks beginning about 100 m upstream from its confluence with the St. Lawrence. At that location, birds were counted from the edge of the flooded area.

In all, 31 species were observed during the Chenal du Nord surveys. Of those species, 22 used the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat [0 m–25 m]) (Table 7). The immediately adjacent habitat was slightly higher in species richness and pair density than the vegetated riparian strip. This can be explained at least in part by the diversity of the immediately adjacent habitat, which, although dominated by annual cropland, also includes perennial cropland, a small wooded area and swamps.

Table 7. Mean relative abundance per kilometre of shoreline and habitats used by birds: Chenal du Nord and adjacent habitats, 2017 surveys

Code[1]	Species	Watercourse and riparian strip[2]		Adjacent habitat 0-25 m		Total riparian zone[4]	Adjacent habitat > 25 m	
		Mean abundance (pairs / km)	Habitat[3]	Mean abondance (pairs / km)	Habitat[5]	Mean abundance (pairs / km)	Mean abondance (pairs / km)	Habitat[5]
H	American Crow	0.45	In flight			0.45	0.45	UF
H	American Goldfinch	0.45	H+S+T			0.45		
S	American Redstart			0.91	FO	0.91	0.91	SW
P	American Robin	0.91	H; T			0.91	1.82	HU
H	Bald Eagle						0.45	SW
T	Baltimore Oriole	0.91	T			0.91	0.91	SW
H	Barn Swallow	0.45	In flight			0.45		
S	Black-capped Chickadee			0.91	SW	0.91		
S	Chipping Sparrow						0.91	HU
JE	Common Grackle	1.82	T; H+T; H+S+T	0.45	PC	2.27		
T	Common Yellowthroat			0.91	FO	0.91	1.82	OF; HU
S	Eastern Kingbird	0.91	T			0.91		
T	Eastern Phoebe						0.91	HU
S	Eastern Wood-Pewee			0.91	SW	0.91		
JE	European Starling	0.91	In flight			0.91	1.36	HU
H	Gadwall						0.45	MA
S	House Finch						0.91	HU
JE	Killdeer			1.82	AC; UF	1.82		
P	Mallard	0.91	W			0.91		
S	Mourning Dove						0.91	HU
S	Northern Cardinal						0.91	HU
P	Northern Flicker	0.91	H+S+T			0.91		
S	Red-breasted Nuthatch			0.45	FO	0.45		
S	Red-eyed Vireo						0.91	SW
AT	Red-winged Blackbird	4.09	T; H+S; H+T; H+S+T			4.09	0.91	HU
H	Ring-billed Gull						21.82	UF
T	Song Sparrow	4.55	T; H+T; H+S+T	2.73	FO	7.27	4.55	OF; FH, HU; WM
T	Spotted Sandpiper			0.45	PC	0.45	1.36	HU; WM
H	Tree Swallow	0.45	In flight			0.45		
T	Warbling Vireo			2.73	FO; SW	2.73	0.91	FO; SW
P	Yellow Warbler	0.45	H+T	4.55	FO; SW	5.00	1.82	OF; FO; SW
	(Total: 31 species)		**Vegetated riparian strip only**					
	Total	18.18	15.01	16.82		35.00	45.00	
	Number of species	14	9	11		22	20	

[1] Code = Category of breeding evidence observed (using codes from the Quebec Breeding Bird Atlas). Descriptions of the categories appear in Appendix E.

[2] Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

[3] W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

[4] Total riparian zone = water + bank + riparian strip + adjacent habitat (0 m–25 m).

[5] Habitat codes: AC = annual cropland; PC = perennial cropland; OW = open water; OF = old field; FH = farm hedgerow; MA = marsh; SW = swamp; HU = human-modified environment; FO = forested area; WM = wet meadow; UF = uncultivated farmland.

The species encountered most frequently in the riparian zone were (in decreasing order) the Song Sparrow, the Yellow Warbler, the Red-winged Blackbird, the Warbling Vireo

and the Common Grackle; together, they represented 61% of the pairs observed. The Song Sparrow and the Common Grackle were 1.7 and 4 times more abundant, respectively, in the riparian strip than in the immediately adjacent habitat. The Red-winged Blackbird was seen only in the riparian strip, specifically in areas with shrubs, trees and herbaceous cover. The Yellow Warbler and the Warbling Vireo were more numerous in the nearby wooded areas and swamps than in the riparian strip (in the case of the Yellow Warbler, 10 times more numerous).

A number of species were observed in or on the edge of a small eastern cottonwood young stand in the immediately adjacent habitat: the Baltimore Oriole, the American Redstart, the Yellow Warbler, the Common Yellowthroat, the Northern Flicker, the Eastern Kingbird, the Warbling Vireo and – despite the absence of conifers – the Red-breasted Nuthatch. The Eastern Wood-Pewee (designated Special Concern in Canada) was found in a treed swamp in the immediately adjacent habitat to the northeast of the watercourse, while the Barn Swallow (designated Threatened in Canada) and the Tree Swallow were feeding while flying over the watercourse. Two species associated with aquatic environments were seen: the Mallard and the Spotted Sandpiper. Breeding of the European Starling, the Killdeer and the Common Grackle in the riparian zone was confirmed when young fledglings were observed. A Red-winged Blackbird was seen carrying food for its young, but the location of its nest was not determined.

The birds observed in the more distant adjacent habitats (> 25 m) provide an indication of the species that frequent the landscape surrounding Chenal du Nord. In all, 20 species were observed in these habitats, which consisted mostly of annual and perennial cropland but also included swamps and human-modified environments. The large number of Ring-billed Gulls was attributable to the bare fields from which the flood waters had receded only a short time before, creating ideal resting and foraging sites for the species. The Song Sparrow was also abundant in the more distant adjacent habitats, for example, in farm hedgerows. The species seen in the swamps were typical of that type of habitat: the Baltimore Oriole, the American Redstart, the Yellow Warbler, the Red-eyed Vireo and the Warbling Vireo. There was also a Bald Eagle (designated vulnerable in Quebec) sitting on a perch at the edge of the Grand (large) Chenal du Nord (St. Lawrence River). The species associated with human-modified environments were the Chipping Sparrow, the Northern Cardinal, the Eastern Phoebe, the House Finch and the Mourning Dove.

Four other species flew over the site without stopping: the Canada Goose (6 individuals), the American Black Duck (1 individual), the Common Raven (2 individuals) and the Great Blue Heron (1 individual).

3.2.4 Fossé de la Baie

Fossé de la Baie was surveyed twice, on June 13 and 25, 2017. The surveys were carried out between sunrise and 9:00 a.m. under ideal weather conditions. The watercourse had overflowed its banks in a few places, but it was still possible to survey the entire transect.

In all, 33 species were observed during the surveys of Fossé de la Baie, including 30 that were using the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat) (Table 8). The riparian strip and the immediately adjacent habitat had a similar number of species (13 and 14, respectively) and pair density (8.5 and 7.2 pairs per kilometre of shoreline, respectively, excluding Canada Geese).

The Mallard and the Canada Goose together made up 69% of the pairs observed in the riparian zone, but they may have been abundant because of the high water levels. The other species observed most frequently in the riparian zone were (in descending order) the Red-winged Blackbird, the Song Sparrow and the Yellow Warbler tied for second place, the Killdeer, the Spotted Sandpiper and, in a three-way tie for fifth place, the Savannah Sparrow, the Bobolink (designated Threatened in Canada) and the Common Grackle. When the Mallard and the Canada Goose are excluded, these remaining eight species represented 67% of the pairs observed. The Red-winged Blackbird, the Song Sparrow and the Spotted Sandpiper were 2.5 to 6.8 times more abundant in the riparian strip than in the immediately adjacent habitat. The Red-winged Blackbird was observed in herbaceous riparian strips with or without woody vegetation, while the Song Sparrow was always observed near trees or shrubs. The Spotted Sandpiper was found in herbaceous riparian strips. Compared to the riparian strip, the immediately adjacent habitats were used by 2.5 times as many Yellow Warblers (swamps) and twice as many Common Grackles (farm hedgerows). The Killdeer was observed only in the parts of the adjacent habitat with annual crops or bare soil. Lastly, the Bobolink and the Savannah Sparrow were more abundant when there were perennial crops in the immediately adjacent habitat. These two species were sometimes seen using shrubs in the vegetated riparian as singing perches.

The swamps at the northeastern end of the watercourse were frequented by the Least Flycatcher, the Yellow Warbler, the Eastern Wood-Pewee (designated Special Concern in Canada), the House Wren, the Red-eyed Vireo and the Warbling Vireo. The Tree Swallow and the Barn Swallow (designated Threatened in Canada) foraged in flight above the watercourse and the farm fields.

Aquatic species, including up to 112 Mallards, 84 Canada Geese and one Snow Goose, used the watercourse as a foraging or resting site. The American Black Duck (1 pair) and the Gadwall (1 individual) were also observed there.

Two raptor species were observed: a Bald Eagle (designated vulnerable in Quebec), flying low over the watercourse, and a Red-tailed Hawk, perched in a nearby farm hedgerow.

The birds observed in the more distant adjacent habitats (> 25 m) provide an indication of the species that frequent the landscape surrounding Fossé de la Baie. In all, 11 species were observed in those habitats, which consisted mainly of annual cropland, with some perennial crops and swamps. The Song Sparrow, the Savannah Sparrow, the European Starling and the Bobolink were observed in farm fields, while the American Robin, the Least Flycatcher, the Yellow Warbler, the Eastern Wood-Pewee, the Great Crested Flycatcher and the Warbling Vireo were associated with wooded and swampy areas.

Two species, the Ring-billed Gull (5 individuals) and the Cedar Waxwing (1 individual), flew over the site but did not land.

Table 8. Mean relative abundance per kilometre of shoreline and habitats used by birds: Fossé de la Baie and adjacent habitats, 2017 surveys

Code[1]	Species	Watercourse and riparian strip[2]		Adjacent habitat 0-25 m		Total riparian zone[4]	Adjacent habitat > 25 m	
		Mean abundance (pairs / km)	Habitat[3]	Mean abondance (pairs / km)	Habitat[5]	Mean abundance (pairs / km)	Mean abondance (pairs / km)	Habitat[5]
H	American Bittern	0.27	H			0.27		
P	American Black Duck	0.27	W			0.27		
H	American Crow	0.14	In flight			0.14		
T	American Goldfinch	0.54	T; H+S+T			0.54		
S	American Redstart	0.27	T			0.27		
A	American Robin	0.27	T			0.27	0.14	FO
H	Bald Eagle	0.14	In flight			0.14		
H	Barn Swallow	0.27	In flight			0.27		
T	Bobolink			0.81	PC	0.81	0.54	PC
H	Canada Goose	1.22	W	11.35	AC; UF	12.57		
JE	Common Grackle	0.27	H	0.54	FH	0.81		
S	Downy Woodpecker			0.54	SW	0.54		
T	Eastern Wood-Pewee						0.54	SW
H	European Starling	0.14	H+S			0.14	5.00	AC
H	Gadwall	0.14	W			0.14		
H	Great Blue Heron	0.27	W	0.14	AC	0.41		
S	Great Crested Flycatcher						0.27	SW
T	House Wren			0.27	SW	0.27		
JE	Killdeer			1.35	AC; UF	1.35		
T	Least Flycatcher			0.27	SW	0.27	0.27	SW
P	Mallard	26.89	W			26.89		
T	Red-eyed Vireo	0.27	T			0.27		
H	Red-tailed Hawk			0.14	FH	0.14		
P	Red-winged Blackbird	2.57	H; S; H+S; H+S+T	0.54	AC; FH	3.11		
T	Savannah Sparrow	0.81	H; H+S			0.81	1.08	AC; PC
X	Snow Goose	0.14	W			0.14		
JE	Song Sparrow	1.35	S; T; H+S; H+S+T	0.54	AC; SW	1.89	1.62	FH; FO; UF
T	Spotted Sandpiper	0.95	H	0.14	AC; UF	1.08		
H	Tree Swallow	0.41	In flight			0.41		
T	Warbling Vireo			0.54	SW	0.54	0.27	FO
T	Willow Flycatcher	0.27	S			0.27		
S	Wilson's Snipe						0.27	
T	Yellow Warbler	0.54	S; H+S+T	1.35	SW	1.89	0.27	FO
	(Total: 33 species)		Riparian strip only					
	Total	38.38	8.51	18.51		56.89	10.27	
	Number of species	23	13	14		30	11	

[1] Code = Category of breeding evidence observed (using codes from the Quebec Breeding Bird Atlas). Descriptions of the categories appear in Appendix E.

[2] Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

[3] W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

[4] Total riparian zone = water + bank + riparian strip + adjacent habitat (0 m–25 m).

[5] Habitat codes: AC = annual cropland; PC = perennial cropland; OW = open water; OF = old field; FH = farm hedgerow; MA = marsh; SW = swamp; HU = human-modified environment; FO = forested area; WM = wet meadow; UF = uncultivated farmland.

The swamps at the northeastern end of Fossé de la Baie contributed to the species richness observed during the surveys. Among the birds present was the Eastern Wood-Pewee, designated Special Concern in Canada. The photograph was taken on June 13, 2017. (Photo: Alexandre Nicole)

The high water level in Fossé de la Baie in 2017 created suitable resting and foraging sites for the Mallard and the Canada Goose. The photograph was taken on June 13, 2017. The bird in the photo is a Snow Goose. (Photo: Alexandre Nicole)

Conclusion

Segment 5

The point counts were carried out in Segment 5 under passable weather conditions at a time when most of the site was covered with water; only one visit of the entire site could be completed. Because of the exceptional flooding, a number of species that forage in aquatic and wetland environments, namely the Canada Goose, the Mallard, the Ring-billed Gull, the Great Blue Heron, the Great Egret, the Black Tern, the Tree Swallow, the Bald Eagle and the Turkey Vulture, were observed there, sometimes in very large numbers. Two species at risk were found on the site: the Eastern Wood-Pewee (designated Special Concern in Canada), and the Bald Eagle (designated vulnerable in Quebec).

The site has an extensive network of watercourses and drainage ditches, but without flooding they would not attract large numbers of certain species like those that visited the flooded agricultural fields in 2017. Outside the flooded areas, where there was more vegetation (herbaceous riparian strips, farm hedgerows, swamps), five generalist species, the Song Sparrow, the Red-winged Blackbird, the European Starling, the Yellow Warbler and the Common Grackle (Maisonneuve et al., 1996; Gagnon-Lupien, 2013), were the most abundant. In the course of a "normal" year, i.e., one during which the watercourses do not overflow their banks and the crops reach a certain height by June, these five species would probably have been as or more abundant, while species attracted by higher water levels would have made up a very small proportion of the total.

In short, the restoration of Segment 5 will create new habitats that are highly likely to increase overall avian diversity on the site. However, from year to year, flood dynamics will affect the abundance and even the presence of many species, especially those attracted to water and those that nest on or near the ground.

Watercourses

The watercourse surveys were carried out under ideal weather conditions at a time when water levels were high but the watercourses did not overflow the banks except in a very few places. The Song Sparrow, the Red-winged Blackbird, the Yellow Warbler and the Common Grackle were among the most abundant species along the four watercourses. In the Îles de Berthier area, the largest numbers of species and of pairs per kilometre of shoreline were generally recorded within the vegetated riparian strips. That difference was smaller for the watercourses in the Sainte-Geneviève-de-Berthier area, where the riparian strips were often devoid of vegetation.

Overall, Chenal du Nord, located in an intensive-agriculture area, was the watercourse with the lowest number of species in total (22) and the lowest number of pairs per kilometre of shoreline (35). The watercourses with the greatest species richness were (in descending order) Fossé de la Baie (30), Marais de la Presqu'île (28) and De Biais Creek (25). Each of those three watercourses was frequented by more than 50 pairs per kilometre of shoreline. However, at Fossé de la Baie, the count would be fewer than 20 pairs per kilometre if the Mallard and the Canada Goose, two species attracted by the high water levels, were excluded.

The watercourses with larger numbers of species and higher pair densities were generally those characterized by denser vegetation and greater structural diversity of habitats.

It will be interesting to measure the impact of the restoration on avian species richness and abundance along these four watercourses in the coming years.

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Appendix A

Segment 5 point count field sheet

SONGBIRD SURVEY, SEGMENT 5, SAINT-BARTHÉLEMY, SUMMER 2017

STATION No:	OBSERVER:	TEMPERATURE:
Visit No (1 or 2):	No of PAGES FOR THIS STATION:	WIND:
DATE:		PRECIPITATIONS:
TIME (START - END):		CLOUD COVER:

SPECIES	

- WIND:
- **0**: NO WIND
- **1**: LIGHT WIND (LEAVES MOVE)
- **2**: MODERATE WIND (BRANCHES MOVE)
- **3**: STRONG WIND (BRANCHES BEND)
- **4**: HIGH WIND (BRANCHES BREAK)

- PRECIPITATIONS:
- **0**: NO PRECIPITATION
- **1**: DRIZZLE
- **2**: LIGHT RAIN
- **3**: HEAVY RAIN
- **4**: THUNDERSTORM

- CLOUD COVER:
- **0**: CLEAR
- **1**: PARTLY CLOUDY
- **2**: OVERCAST

COMMENTS:

- TYPE OF CONTACT:
- **T**: TERRITORIAL BEHAVIOR (SONG)
- **C**: CALL
- **H**: VISUAL OBSERVATION IN THE HABITAT
- **F**: FLYING
- **A**: FLYING OVER THE HABITAT (HIGH IN THE AIR)
- **N**: NEST
- **F**: FAMILY

- SEX: ♂: MALE, ♀: FEMALE

- DISTANCE BETWEEN BIRD AND STATION:
- **I**: WITHIN 75-M RADIUS
- **O**: OUTSIDE 75-M RADIUS

- POSITION OF BIRDS:
- **A**: WITHIN THE ENHANCEMENT AREA
- **O**: OUTSIDE THE ENHANCEMENT AREA
- **P**: ON THE STRIP OF PRIVATELY OWNED LAND

- HABITAT USED:
- **AC**: ANNUAL CROPLAND
- **PC**: PERENNIAL CROPLAND
- **UF**: UNCULTIVATED FARMLAND
- **FH**: FARM HEDGEROW
- **OW**: OPEN WATER
- **OF**: OLD FIELD
- **MA**: MARSH
- **SW**: SWAMP
- **HU**: HUMAN-MODIFIED ENVIRONMENT
- **FO**: FORESTED AREA
- **WM**: WET MEADOW

Appendix B

Segment 5 point count coordinates

Point	Latitude	Longitude
SEG5-01	46.17438177	-73.04370087
SEG5-02	46.17553885	-73.04077718
SEG5-03	46.17669586	-73.03785336
SEG5-04	46.17785280	-73.03492942
SEG5-05	46.17321301	-73.04371054
SEG5-06	46.17437010	-73.04078690
SEG5-07	46.17552711	-73.03786315
SEG5-08	46.17668405	-73.03493927
SEG5-09	46.17262281	-73.04225843
SEG5-10	46.17377986	-73.03933480
SEG5-11	46.17493683	-73.03641105
SEG5-12	46.17609373	-73.03348717
SEG5-13	46.17145405	-73.04226813
SEG5-14	46.17261110	-73.03934456
SEG5-15	46.17376808	-73.03642087
SEG5-16	46.17492498	-73.03349706
SEG5-17	46.17086383	-73.04081609
SEG5-18	46.17202085	-73.03789252
SEG5-19	46.17317779	-73.03496883
SEG5-20	46.17085209	-73.03790231
SEG5-21	46.17200903	-73.03497868

Appendix C

Watercourse transect field sheet

SONGBIRD SURVEY: WATERCOURSES, SUMMER 2017

STATION No:	OBSERVER:	TEMPERATURE:
Visit No (1 or 2):	No of PAGES FOR THIS STATION:	WIND:
DATE: JUNE 2017		PRECIPITATIONS:
TIME (START - END):		CLOUD COVER:

SPECIES	No OF INDIVIDUALS	TYPE OF CONTACT	SEX	LOCATION (O, B, V, A)	IF RIPARIAN STRIP - HABITAT (H, U, T)	ADJACENT HABITAT – 1 or 0 (1st 25 m)	ADJACENT HABITAT - HABITAT TYPE	COMMENTS

- **WIND:**
  - 0: NO WIND
  - 1: LIGHT WIND (LEAVES MOVE)
  - 2: MODERATE WIND (BRANCHES MOVE)
  - 3: STRONG WIND (BRANCHES BEND)
  - 4: HIGH WIND (BRANCHES BREAK)
- **PRECIPITATIONS:**
  - 0: NO PRECIPITATION
  - 1: DRIZZLE
  - 2: LIGHT RAIN
  - 3: HEAVY RAIN
  - 4: THUNDERSTORM
- **CLOUD COVER:**
  - 0: CLEAR
  - 1: PARTLY CLOUDY
  - 2: OVERCAST

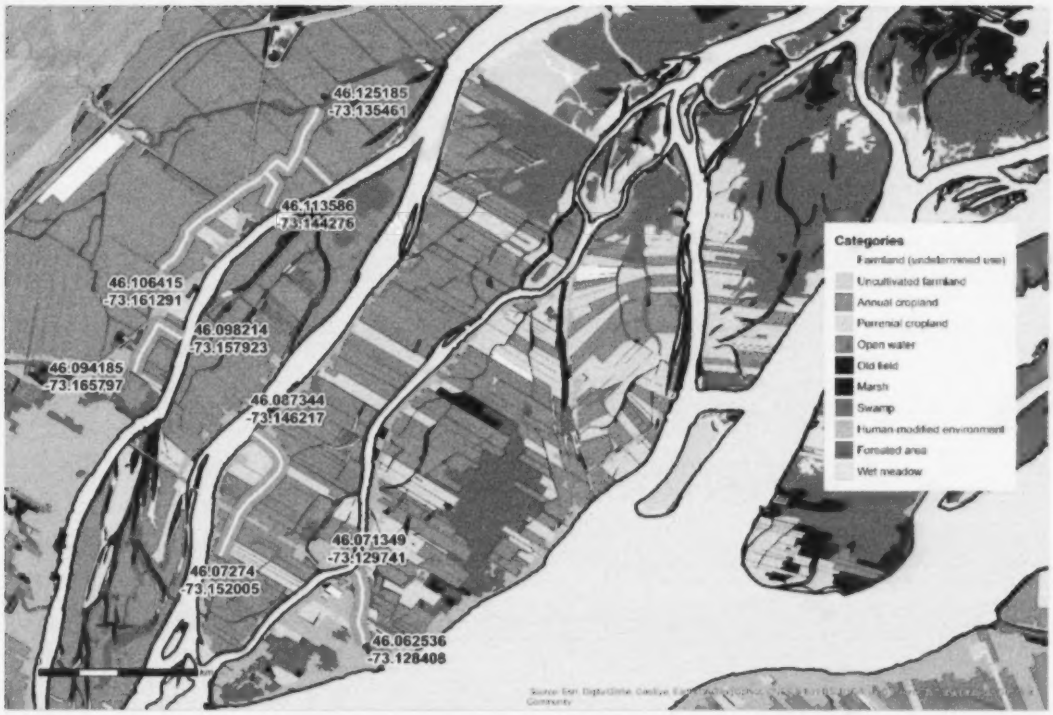
COMMENTS:

- **TYPE OF CONTACT:**
  - T: TERRITORIAL BEHAVIOR (SONG)
  - C: CALL
  - H: VISUAL OBSERVATION IN THE HABITAT
  - F: FLYING
  - A: FLYING OVER THE HABITAT (HIGH IN THE AIR)
  - N: NEST
  - F: FAMILY
- **SEX:** ♂: MALE ♀: FEMALE
- **LOCATION OF BIRD:**
  - O: OPEN WATER
  - B: BANK
  - V: VEGETATED RIPARIAN STRIP
  - A: ADJACENT HABITAT
- **VEGETATED RIPARIAN STRIP – HABITAT USED:**
  - H: HERBACEOUS
  - U: SHRUBS
  - T: TREES
- **ADJACENT HABITAT – POSITION OF BIRD: INSIDE OR OUTSIDE THE 1st 25 m:**
  - I: INSIDE O: OUTSIDE
- **ADJACENT HABITAT – HABITAT TYPE USED BY BIRD:**
  - AC: ANNUAL CROPLAND
  - PC: PERENNIAL CROPLAND
  - UF: UNCULTIVATED FARMLAND
  - FH: FARM HEDGEROW
  - OW: OPEN WATER
  - OF: OLD FIELD
  - MA: MARSH
  - SW: SWAMP
  - HU: HUMAN-MODIFIED ENVIRONMENT
  - FO: FORESTED AREA
  - WM: WET MEADOW

Appendix D

Watercourse transect coordinates

(Source: ECCC and MDDELCC, 2017)



Appendix E

Breeding evidence codes from the *Québec Breeding Bird Atlas (2017)*

SPECIES OBSERVED

X	Species observed during its breeding season, but in habitat unsuitable for nesting (no evidence of breeding).

POSSIBLE BREEDING

H	Species observed in suitable nesting habitat during its breeding season.
S	Individual singing, or sounds associated with reproduction (e.g., calls, drumming) heard in suitable nesting habitat during the species' breeding season.

PROBABLE BREEDING

M	At least 7 individuals singing or producing sounds associated with reproduction (e.g., calls, drumming) heard during a single visit in suitable nesting habitat during the species' breeding season.
P	Pair observed in suitable nesting habitat during the species' breeding season.
T	Presumed territory based on the presence of an adult bird, whether producing sounds associated with breeding (e.g., song, other calls or drumming) or not, at the same place, in suitable nesting habitat, on at least two visits, one week or more apart, during the species' breeding season.
C	Breeding behaviour involving a male and female (e.g., display, courtship feeding and copulation) or antagonistic behaviour between two or more individuals (e.g., territorial disputes or chases), in suitable nesting habitat during the species' breeding season.
V	Bird visiting a probable nest site in suitable habitat during the species' breeding season.
A	Agitated behaviour or alarm calls of an adult in suitable habitat during the species' breeding season.
B	Brood patch or cloacal protuberance on an adult individual caught in suitable nesting habitat during the species' breeding season.
N	Nest building by wrens or nest hole excavation by woodpeckers..

CONFIRMED BREEDING

CN	Nest building, including the carrying of nesting material, by all species except wrens and woodpeckers.
DD	Individual attempting to draw attention away from a nest or young by feigning injury or by using any other distraction display.
NU	Empty nest used during the atlas survey period, or the shells of eggs laid during the same period.
JE	Recently fledged (nidicolous species) or downy (nidifugous species) young incapable of sustained flight.
NO	Adult leaving, occupying or entering a probable nest site (visible or not) whose behaviour is suggestive of an occupied nest.
FE	Adult carrying a fecal sac.
AT	Adult carrying food for one or more young.
NF	Nest containing one or more eggs.
NJ	Nest containing one or more young (seen or heard).

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